Wilson Bull., 94(3), 1982, pp. 303–312

MIGRATION PATTERNS OF RED AND NORTHERN PHALAROPES IN SOUTHWEST DAVIS STRAIT AND IN THE NORTHERN LABRADOR SEA

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Red Phalaropes (*Phalaropus fulicarius*) and Northern Phalaropes (*Lobipes lobatus*) are circumpolar shorebirds which breed, with some overlap, in the High and Low Arctic, respectively. In eastern North America the Red Phalarope breeds south to ca. 60°N in Canada and ca. 69°N in Greenland; the corresponding limits are ca. 54°N and ca. 60°N for the Northern Phalarope (Salomonsen 1950/51, Godfrey 1966). Both species winter at sea. Western Hemisphere populations probably migrate to the waters off the west coast of South America (Murphy 1936), though it is possible that Red Phalaropes from eastern North America may also winter off West Africa (Stanford 1953, Brown 1979).

The little that is known of the timing and routes of phalarope migrations comes mainly from sporadic, shore-based observations. Large flocks of Red Phalaropes are regularly reported off New England and Nova Scotia in May or earlier: at the eastern edge of Georges Bank (ca. 41°N, 66°W) from March to May (Lamb 1964; K. D. Powers, pers. comm.); south of Nova Scotia (ca. 43°N, 66°W) on 27 May 1980 (J. F. Kearney, pers. comm.); off Sable Island (ca. 44°N, 60°W) on 29–30 May 1977 (Anon. 1977) and from 31 May–6 June 1980 (E. L. Mills, pers. comm.); in the southern Bay of Fundy (ca. 44°N, 67°W) on 2 June 1981 (R. D. Burns, pers. comm.). Similarly, large numbers of Northern Phalaropes were seen in the Bay of Fundy off Brier Island (ca. 44°15′N, 66°25′W) on 21–23 May 1976 (Anon. 1976). However, few birds of either species remain in southern Canadian waters by the middle of June (Moore 1951, Brown et al. 1975). The first Red Phalaropes reach their breeding grounds between about 28 May–15 June, while northerns arrive a little earlier (Soper 1946, Salomonsen 1950/51, Sutton and Parmelee 1956, Watson 1957, Macpherson and McLaren 1959, Parmelee et al. 1967, Höhn 1971, Mayfield 1979).

There is only a short interval between the end of the phalaropes' spring migration and their return in the fall. This reflects the temporary nature of the pair-bond and the brevity of parental care in these species. Most females leave in early July after they have laid their eggs; the males incubate, and leave in early August, after the young have hatched but before some of them can fly; the juveniles migrate last (Sutton 1932, Salomonsen 1950/51, Tuck and Lemieux 1959, Parmelee et al. 1967, Höhn 1971,

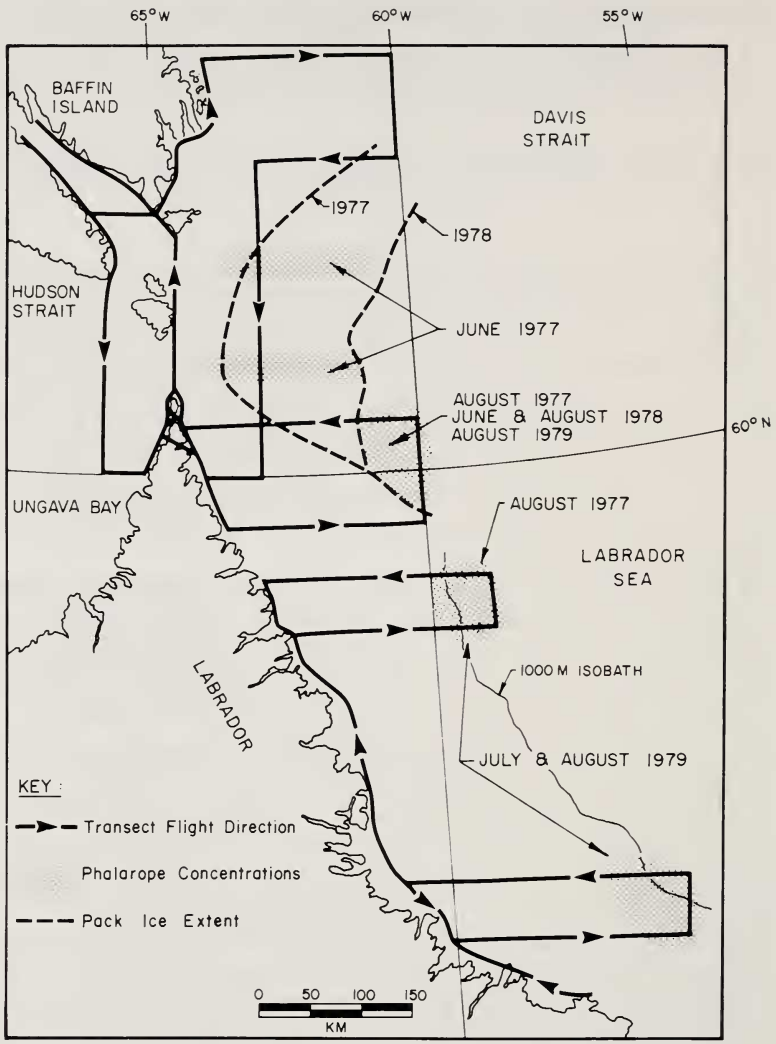

FIG. 1. Aerial survey routes flown off southeast Baffin Island and northeast Labrador in 1978 (north of 59°N) and in 1979 (south of 59°N). The shaded areas give the approximate positions of large concentrations of phalaropes, seen from both aerial and shipboard surveys (see also Table 1, and Brown [1980: Fig. 4]). The 1000-m isobath marks the approximate centre of the Continental Slope.

Kistchinski 1975, Mayfield 1979). Large numbers of Red Phalaropes have been seen off the northern tip of Labrador as early as 22 July (Gross 1937), and birds also return to Newfoundland waters in July (Wynne-Edwards 1935, Brown et al. 1975). They reach a fall staging area off Brier Island in

TABLE 1

MEAN NUMBER OF RED PHALAROPES SEEN DURING 10-MIN SHIPBOARD TRANSECTS AT VARYING DISTANCES OFF NORTHEAST LABRADOR AND SOUTHEAST BAFFIN ISLAND[a]

Date: °N:	5–10 Aug. 1978 54°00′–55°59′	1–9 Aug. 1977 57°45′–58°59′	12–18 Aug. 1977 59°45′–60°30′	18–19 Aug. 1979 60°00′–61°05′	9–20 June 1977 60°56′–64°06′
Distance offshore (km):					
<50	—	*0.4 (5)*	*0.2 (8)*	*0 (7)*	—
50–74	*0 (4)*	*0 (4)*	*0 (4)*	*0 (13)*	*20.2 (6)*
75–99	*0 (2)*	*0 (5)*	*0 (4)*	—	*17.9 (11)*
100–124	*0 (5)*	750.7 (3)	*0 (4)*	—	*13.1 (9)*
125–149	0 (1)	25.0 (2)	30.0 (5)	—	*88.7 (7)*
150–174	75.2 (8)	0 (1)	987.7 (6)	—	4.1 (8)
175–199	0.2 (4)	—	0 (2)	70.8 (6)	4.1 (16)
>200	12.5 (12)	—	0 (1)	5.5 (23)	0.1 (62)
P	<0.05	NS	<0.05	NS	<0.001

[a] Sample sizes are in parentheses. One-tailed probabilities (*P*) refer to Mann-Whitney *U*-tests for the differences between transects inside (italics) and outside the 400-m isobath (August), or inside (italics) and outside the pack-ice zone (June).

late July or early August (R. G. B. Brown, unpubl.). Similarly, Northern Phalaropes arrive off Deer Island (ca. 45°N, 67°W), on the opposite side of the Bay of Fundy, in late July, and numbers there may exceed two million by late August (Vickery 1978). The birds arrive off Cape Cod (ca. 42°N, 70°W) in late July, with a migration peak from the end of August to mid-September (Griscom 1939). Red Phalaropes are scarcer in that area and occur farther offshore, mainly from late August to late September, but with stragglers as late as early November (Griscom 1939, see also Moore 1951).

There is clearly a need for more information on phalarope migration, preferably collected at sea and in a systematic, quantitative way. This paper describes phalarope distributions off northeast Labrador and southeast Baffin Island (55°–64°N; see Fig. 1), based on aerial surveys supplemented by shipboard observations but deals primarily with the Red Phalarope. The two species cannot be distinguished during aerial observations, and it is often hard to identify birds in winter plumage from ships. Nonetheless, it was clear from shipboard observations that the overwhelming majority of birds, including those in all the offshore concentrations (Fig. 1, Table 1), were Red Phalaropes.

METHODS

Aerial survey procedures were similar to those described by Nettleship and Gaston (1978). Fig. 1 shows the transect lines; the area from 59°30′–64°N was surveyed in 1978 and that from 55°–59°N in 1979. In 1978, 18 surveys, each requiring 2 days to complete, were flown

at intervals of 7–10 days from 22 April–5 October, with a final survey on 2 and 6 November. There were 11 surveys in 1979, flown every 2 weeks from 30 May through 12–13 October. The total length of the transect line was 54,750 km in 1978 and 16,582 km in 1979. A DeHavilland Twin-Otter was used in 1978 and a Cessna 337 in 1979 with GNS-500 Global and CMA-734 Omega Navigation systems, respectively (Karant 1976). The aircraft flew 30 m (100 ft) above the sea, at an air speed of 180 km/h (100 kt). The observers sat in the right front (co-pilot's) seat, and in the left rear passenger seat immediately behind the pilot. All birds seen within a 200-m strip on each side of the aircraft were counted and data on species, numbers and activity collected; time and ice cover were noted. All information was taken on cassette tape-recorders. The counts are minimum estimates, since animals are usually under-counted on transect surveys (Eberhardt 1978). To maintain observer efficiency, observation periods never exceeded 2 h (Norton-Griffiths 1976).

Observations were also made from oceanographic survey ships. Birds were counted during 10-min watches while the ship was steaming in excess of 7.6 km/h (4 kt) (Brown et al. 1975). Unlike the aerial surveys, it was not possible to cover transect lines more than once. One cruise was made in the spring (9–20 June 1977) off southeast Baffin Island from ca. 61°W west to the edge of the pack-ice at ca. 63°30′W, along transect lines at ca. 61°N and ca. 63°N (Fig. 1). There were three cruises in late summer off Labrador: 31 July–20 August 1977, 3–12 August 1978, and 10–26 August 1979. All three cruises covered areas from the coast out to the edge of the Continental Shelf. The 1977 and 1978 cruises were north and south of 56°N (Brown 1980: Fig. 5), respectively, and the 1979 cruise from ca. 54°–61°N (R. G. B. Brown, unpubl.).

RESULTS

Spring migration.—Our observations are consistent with the arrival dates reported in the literature (see above). Red Phalaropes were already in southwest Davis Strait when the shipboard survey began on 9 June 1977, and apart from a few stragglers, passage through the area was completed by 16 June. In 1978, the phalaropes arrived between the aerial surveys of 4 and 9 June and numbers peaked in mid-June (Fig. 2). Orr observed phalaropes (predominantly reds) arriving on the tundra around Frobisher Bay settlement, southeast Baffin Island (63°45′N, 68°31′W), in late June 1978.

Concentrations of phalaropes were observed well offshore of southeast Baffin Island and northern Labrador in early June, both during the 1977 shipboard and the 1978 aerial surveys (Fig. 1, Table 1). These birds were just east of the edge of the pack-ice. They appeared to avoid dense pack-ice; almost all (over 90%) were seen in areas where the observers estimated that less than 40% of the surface was ice-covered. The majority of the birds were sitting on the water and probably feeding. Similarly, Macpherson and McLaren (1959) saw large flocks in mid-June at the edge of the landfast ice in northwest Hudson Strait. By mid-June 1978 flocks of phalaropes were flying across stretches of denser pack-ice in Davis and Hudson straits, probably en route to breeding areas farther north and west.

Fall migration.—In 1978 our aerial surveys showed a fairly rapid fall migration off southeast Baffin Island and northeast Labrador (Fig. 2).

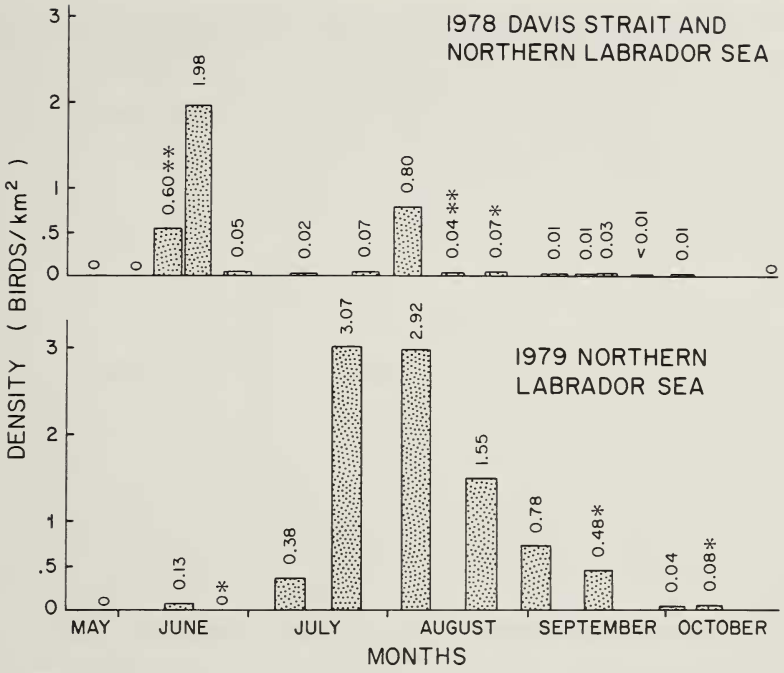

FIG. 2. Seasonal variations in phalarope numbers in the region of the Continental Slope (400–2000-m isobaths) off northeast Labrador and southeast Baffin Island, as shown by aerial surveys in 1978 and 1979. Asterisks indicate surveys in which birds were also seen inshore of the Slope: * <0.05 birds/km²; ** 0.05–0.1 birds/km².

Numbers peaked on the flights on 1–2 August, and very few birds were seen later. In 1979, however, migration off northeast Labrador began earlier, peaking on 24–25 July and 7–13 August. There was a gradual decline after this, but significant numbers of birds remained until early September. The difference between the 2 years may have been at least partly due to viewing conditions; strong winds in July 1978 made the birds harder to see from the air. However, 1978 was an unusually severe summer in the High Arctic, and several species of seabirds either bred late or did not breed at all (D. N. Nettleship, pers. obs.). Another Arctic shorebird, the Semipalmated Sandpiper (*Calidris pusilla*), reached the Bay of Fundy 2–3 weeks later in 1978 than in 1979, and in smaller numbers than usual (P. W. Hicklin, pers. comm.). The numbers of Red Phalaropes off Brier Island were also unusually low in August 1978 (R. G. B. Brown, unpubl.). It is therefore possible that Red Phalaropes did not attempt to breed in the eastern Canadian Arctic in 1978, and instead migrated south, en masse, soon after they arrived.

Even allowing for between-year differences, there appears to be a delay of nearly 2 weeks between the first departures of breeding birds in early July, and the first arrivals in our survey area at the end of that month. The distance to be travelled may account for part of this, but there is also evidence that some birds begin their molt at or near their breeding areas before they set off on migration (Kistchinski 1975).

In both years phalaropes occurred only well offshore during their fall migration down the Labrador coast. On both our aerial and shipboard surveys we found that the birds were virtually confined to the waters above the Continental Slope, between the 400- and 2000-m isobaths (Figs. 1, 2; Table 1). This zone is also at the outer edge of the Labrador Current, and surface water temperatures increase fairly abruptly farther east by ca. 1°–2°C (Brown 1980: Figs. 4, 5). During our 1978 aerial surveys we estimated a peak average density of 5.73 birds/km^2 over the Slope, on 1 August. In 1979 the peak densities over the Slope on our northern and southern transect lines were 1.98 and 23.04 birds/km^2 on 24–25 July, and 6.50 and 17.31 on 7 and 13 August, respectively. The total area of water overlying the Slope from 55°30′N–59°N is ca. 25,000 km^2. If Red Phalaropes were distributed through this zone at an average density of 12.5 birds/km^2 (calculated from the peak densities quoted above), then it is possible that something of the order of 300,000 birds occurred in this zone in late July and early August 1979.

DISCUSSION

Phalaropes at sea feed by sitting on the water and picking at small organisms on or just below the surface (Ridley 1980). Their feeding actions suggest that the birds are aiming at individual prey items. This technique can only be efficient if the density of prey is very high locally. Such conditions occur on the phalaropes' breeding grounds, in the shallow tundra pools where aquatic insects and their larvae are superabundant (e.g., Mayfield 1979), but birds at sea must rely on some oceanographic mechanism to bring their prey to the surface and concentrate it there. The pelagic distributions of both species of phalarope can be interpreted in terms of the occurrence of suitable concentration mechanisms.

Thus, when Red Phalaropes are migrating through southwest Davis Strait (and also in the Bering Sea [Divoky 1979]) in the spring, they are most abundant at or near the edge of the pack-ice. Ice-edge zones are biologically very productive (e.g., McRoy and Goering 1974), and Red Phalaropes are not the only seabirds to exploit them (e.g., Nettleship and Gatson 1978, Bradstreet 1979). The prey found there includes ice-associated crustaceans such as *Apherusa glacialis* and *Onesimus glacialis*, small enough to be taken by birds (e.g., Bradstreet 1980). Red Phalaropes on their way

south through Baffin Bay in the fall are often seen beside icebergs, presumably feeding on this or similar prey (R. G. B. Brown, unpubl.).

However, the birds are more generally associated with 'fronts' and similar boundaries between water bodies when they are at sea farther south, in the fall and winter (Brown 1980). They occur, for example, well offshore of British Columbia, California, Peru, Senegal and Namibia; in all five cases in regions where 'fronts' occur (Murphy 1936, Stanford 1953, Martin and Myres 1969, Ainley 1976, Brown 1979). (Northern Phalaropes occur in the first three of these areas, but closer inshore.) The association between Red Phalaropes and the 'front' at the eastern edge of the Labrador Current has been described above. Zooplankton is trapped and concentrated at the surface in such 'fronts' (Pingree et al. 1974, Brown 1980: Fig. 8), and this is probably what attracts the birds to them, both off Labrador and elsewhere. The ice-edge in southwest Davis Strait and the Labrador 'front' would therefore appear to be potentially rich feeding areas which phalaropes breeding in the eastern North American Arctic may exploit to replenish their energy reserves before embarking on breeding in the spring, molting in late summer or long-distance migration in the fall.

Finally, we conclude from the scarcity or absence of Northern Phalaropes in our survey area that these birds have a different migration route. This species breeds from northern Labrador north to 66°N in Baffin Island (Godfrey 1966), and one would expect their passage between there and the known concentration areas in the Bay of Fundy in spring and fall (see above) to pass through our survey area, if it takes place over the sea. The fact that it apparently does not, seems to indicate an overland migration instead. Northern Phalaropes are known to migrate overland in both western Canada and northwest Europe (e.g., Godfrey 1966, Hildén and Vuolanto 1972), and Richardson (1979) has suggested that part of the eastern Canadian population does so too. The interior of Labrador is virtually uninhabited, and this probably explains why such a passage has gone undetected. It may be that Northern Phalaropes, unlike reds, continue to rely on aquatic insects, their summer food, while they are on their way south in the fall. However, they might also be flying non-stop until they reach the dense concentrations of marine copepods to be found in their staging area in the waters around Deer Island, Bay of Fundy (Fish and Johnson 1937; Vickery 1978; R. G. B. Brown, pers. obs.).

SUMMARY

The timing and routes of the migrations of the Red Phalarope (*Phalaropus fulicarius*) off northeast Labrador and southeast Baffin Island are described from aerial and shipboard surveys made 1977–79. In spring, the birds migrated through the survey area in early and mid-June. The return migration began at the end of July and was completed by mid-August

(1978) or mid-September (1979). Spring migrants were associated with a zone at the edge of the pack-ice, where there was less than 40% ice cover. Fall migrants occurred well offshore, in the area of a 'front' at the outer edge of the Labrador Current, over the Continental Slope. In both cases, the birds were in areas potentially rich in food concentrated at the surface of the water. Northern Phalaropes (*Lobipes lobatus*) were virtually absent, and it is concluded that the population which breeds in northern Labrador and southern Baffin Island migrates overland.

ACKNOWLEDGMENTS

Logistic support and permission to publish these results were provided by Esso Resources Canada Ltd., Aquitaine Co. of Canada Ltd. and Canada Cities Services Ltd. (Davis Strait surveys); Petro-Canada and the oil industry's Labrador Group (Offshore Labrador Biological Studies data); and the Canadian Wildlife Service. Aerial and shipboard observers included J. Brownlie, I. Cameron, D. Gillis, S. Johnson, B. Mactavish, J. Parsons, C. Paton, J. Piatt, M. Purdy, and V. L. Sinclair, as well as the authors. We thank pilots J. MacDonald, R. Michelin, and D. Roy (Bradley Air Services), and F. Fitzpatrick (Labrador Airways), and the ship and scientific personnel of CSS HUDSON and MV LADY JOHNSON II for their help in the field. Computer and statistical assistance was provided by I. Brown; and R. D. Burns, P. Hicklin, J. F. Kearney, S. D. MacDonald, E. L. Mills, D. N. Nettleship, and K. D. Powers gave us unpublished field information. We also thank A. J. Erskine, M. A. Howe, B. Jones, H. F. Mayfield, W. J. Richardson, P. Smith, and D. Stone for their comments on this manuscript. This paper is Report No. 92 of the Canadian Wildlife Service's series 'Studies on northern seabirds'.

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